

## PATENT COOPERATION TREATY

## PCT


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## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 31.13.84301/01		<b>FOR FURTHER ACTION</b>		See Form PCT/IPEA/416
International application No. PCT/GB2004/004047		International filing date (day/month/year) 23.09.2004	Priority date (day/month/year) 23.09.2003	
International Patent Classification (IPC) or national classification and IPC F25J1/02, F25B9/02				
Applicant STATOIL ASA et al.				
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 9 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input type="checkbox"/> sent to the applicant and to the International Bureau a total of sheets, as follows:</p> <p><input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>				
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input checked="" type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input checked="" type="checkbox"/> Box No. VIII Certain observations on the international application</p>				
Date of submission of the demand  25.07.2005		Date of completion of this report  12.10.2005		
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized Officer  Göritz, D  Telephone No. +49 89 2399-		



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**Box No. I Basis of the report**

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1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

**Description, Pages**

1-19 as originally filed

**Claims, Numbers**

1-26 as originally filed

**Drawings, Sheets**

1/5-5/5 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

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**Box No. IV Lack of unity of invention**

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1. ☒ In response to the invitation to restrict or pay additional fees, the applicant has:
- ☐ restricted the claims.
  - ☐ paid additional fees.
  - ☒ paid additional fees under protest.
  - ☐ neither restricted nor paid additional fees.
2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is
- ☐ complied with.
  - ☒ not complied with for the following reasons:  
**see separate sheet**
4. Consequently, this report has been established in respect of the following parts of the international application:
- ☒ all parts.
  - ☐ the parts relating to claims Nos. .

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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1. Statement

Novelty (N)	Yes: Claims	7-9,14,15-25
	No: Claims	1-6,10,11-13,26
Inventive step (IS)	Yes: Claims	-
	No: Claims	1-10,11-14,15-25,26
Industrial applicability (IA)	Yes: Claims	1-26
	No: Claims	-

2. Citations and explanations (Rule 70.7):

**see separate sheet**

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**Box No. VIII Certain observations on the international application**

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The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

1. Reference is made to the following documents:
  - D1: US-A-5 611 216 (HOUSER CLARENCE G ET AL) 18 March 1997
  - D2: US 2003/005722 A1 (HUDSON HANK M ET AL) 9 January 2003
  - D3: US-A-4 539 028 (LEROUX DIDIER ET AL) 3 September 1985
  - D4: US-A-4 094 655 (KRIEGER HEINRICH) 13 June 1978
  - D5: HEINZ BAUER: "A novel Concept" INTERNATIONAL JOURNAL OF HYDROCARBON ENGINEERING, May 2002, pages 59-63, XP009025584
  - D6: WO 01/69149 A (STATOIL) 20 September 2001
  - D7: PARADOWSKI H ET AL: "La liquéfaction des gaz associés" INTERNATIONAL CONFERENCE ON LNG, 15 May 1983, XP002138034
  - D8: US-A-4 339 253 (CAETANI ENZO ET AL) 13 July 1982
  - D9: US-B1-6 449 984 (PARADOWSKI HENRI) 17 September 2002
  - D10: US-A-4 548 629 (CHIU ET AL) 22 October 1985

**Re Item IV**

2. Reference is made to the results of the prior review according to Rule 40.2(e) PCT.

**Claims 1 to 13 and 26 (Re Item V):**

3. The document D1 is regarded as being relevant prior art to the subject-matter of independent claim 1 and discloses (Reference is made to the citations of the International Search Report):

A method of liquefying a hydrocarbon-rich gas (100) by three cascaded refrigeration circuits(300,200,150), each circuit comprising a compressor (18,48,83), wherein the first refrigeration circuit provides preliminary cooling (2,22,28), the second circuit provides the actual liquefaction (68) and the third circuit provides the sub-cooling (74,87) of the hydrocarbon-rich feed stream and wherein at least part (214,224) of the flow of refrigerant from the second circuit is used for the preliminary cooling (directly in 42,54 and indirectly in 28) of the hydrocarbon-rich gas (100). Therefore, the method of D1 both discloses the "further preliminary cooling by the part flow of the second refrigerant" in exchangers 42 and 54 and the (indirect) use of the part flow of the second refrigerant for the "preliminary cooling in at least part of the same temperature range as the first refrigeration circuit" in exchanger 28.

Consequently and notwithstanding the clarity objection below (see Item VIII) the

subject-matter of **claim 1** is not novel (Article 33(2) PCT).

4. The subject-matter of the method **claims 10 and 26** is also not new with respect of the above mentioned reasons (Article 33(2) PCT).
5. Dependent claims 2 to 9 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of Article 33(2)&(3) PCT. The additional features of said claims are partly known from above cited document D1 (**claims 2 to 6**) or form part of the normal consideration of the man skilled in the art (**claims 7 to 9**). Reference is made to the citations D2 to D6 of the International Search Report.  
Consequently, the subject-matter of above mentioned claims appears to lack novelty and/or inventive step (Article 33(2)&(3) PCT).

**Claims 1 to 13 and 26 (Re Item VIII):**

6. **Claims 1, 10 and 26** do not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not clearly defined.  
The three method **claims 1, 10 and 26** have been drafted as separate independent claims. However, it is evident that the subject-matter of said claims does neither involve a plurality of inter-related products, nor different inventive uses of a product or apparatus. Furthermore it would appear that the subject-matter of said claims merely relates to various embodiments of the same process respectively apparatus which do not cover alternative -unitary- solutions to a particular problem. Consequently, the subject-matter of said claims can be covered by a single independent claim followed by dependent claims covering the various embodiments.  
The aforementioned claims therefore lack conciseness. Moreover, lack of clarity of the claims as a whole arises, since the plurality of independent claims makes it difficult, if not impossible, to determine the matter for which protection is sought, and places an undue burden on others seeking to establish the extent of the protection. Hence, **claims 1, 10 and 26** as a whole do not meet the requirements of Article PCT.
7. Moreover, it would appear that the **claims 1, 10 and 26** also do not meet the requirements of Article 6 PCT with respect to the following aspects:  
In said claims the preliminary cooling of the feed stream is defined by the cooling

provided by the first refrigeration circuit. Additionally, a part flow of the second refrigerant is used for the same preliminary cooling. Consequently, this additional cooling must be provided in at least part of the same temperature range.

However, it is clear from the drawings 1, 2 and 4 and the corresponding parts of the description that the part flow of the second refrigerant is used for further preliminary cooling the hydrocarbon-rich flow. This contradiction between the scope of the claims and the described invention makes it difficult, if not impossible, to determine the matter for which protection is sought.

**Claims 11 to 25 (Re Item V):**

8. The document D7 (see fig. 3) is regarded as being relevant prior art to the subject-matter of independent claim 11 and discloses (the references in parentheses applying to this document):

A method of liquefaction comprising a plurality of cooling circuits arranged in a cascade formation (dual MCR cycle), each circuit comprising a compressor (K1,K2), wherein each compressor has a substantially equal share of the total load (table 6).

Consequently, the subject-matter of **claim 11** is not novel (Article 33(2) PCT).

It is noted that claim 11 also lacks novelty with respect to the documents D8 and D9 (Reference is made to the citations of the International Search Report).

9. The subject-matter of independent **claim 15** is new, but does not involve an inventive step (Article 33(3) PCT).

Document D7 (or alternatively D8 or D9) discloses a substantially load balanced mixed refrigerant cascade liquefaction process (cf. figure 3 and table 6)) from which the subject-matter of claim 15 differs in that the refrigerant of the precooling circuit is carbon dioxide.

It is well known from the art, that carbon dioxide as precooling refrigerant in a two respectively three level cascade refrigeration process provides high liquefaction efficiency, see Documents D6 respectively D10. Consequently, it is not apparent that the particular restriction to the carbon dioxide precooling in the process of D7 (or alternatively D8 or D9) leads to any particular unexpected technical effects.

Therefore, it would be obvious to the person skilled in the art, to apply these features with corresponding effect to the process according to document D7 (or alternatively D8 or D9), thus arriving at claimed subject-matter.

10. The subject-matter of the method **claim 25** is also not inventive with respect of the documents D9 and D10 and the reasons mentioned under point 9 (Article 33(3) PCT).
11. Dependent claims 12 to 14 and 16 to 24 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of Article 33(2)&(3) PCT. The additional features of said claims are partly known from above cited documents D7 to D9 (**claims 12 and 13**) or form part of the normal consideration of the man skilled in the art (**claims 14 and 16 to 24**). Reference is made to the citations D6 and D 10 of the International Search Report.

Consequently, the subject-matter of above mentioned claims appears to lack novelty and/or inventive step (Article 33(2)&(3) PCT).

**Claims 11 to 25 (Re Item VIII):**

12. **Claims 11, 15 and 25** do not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not clearly defined.  
The three method **claims 11, 15 and 25** have been drafted as separate independent claims. However, it is evident that the subject-matter of said claims does neither involve a plurality of inter-related products, nor different inventive uses of a product or apparatus. Furthermore it would appear that the subject-matter of said claims merely relates to various embodiments of the same process respectively apparatus which do not cover alternative -unitary- solutions to a particular problem. Consequently, the subject-matter of said claims can be covered by a single independent claim followed by dependent claims covering the various embodiments.  
The aforementioned claims therefore lack conciseness. Moreover, lack of clarity of the claims as a whole arises, since the plurality of independent claims makes it difficult, if not impossible, to determine the matter for which protection is sought, and places an undue burden on others seeking to establish the extent of the protection.



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Hence, **claims 11, 15 and 25** as a whole do not meet the requirements of Article PCT.